

SECTION 06705

FRP DECKING

PART 1 - GENERAL

1.1 SCOPE

- A. This Section includes the requirements for furnishing Fiber Reinforced Polymer (FRP) rail station platforms including materials, design criteria, testing, transportation and installation support. This section applies to both flat panels used for short spans (typically less than 15') and "double-tee" members for long spans (typically 15' to 50'). This work includes the fabrication and finishing of the FRP rail station platforms as well as installation support in accordance with this specification and the contract plans. The installing contractor's work is to include but is not limited to the following:
1. Supply and installation of FRP decking.
 2. Verify in the field all dimensions, elevations and materials required for the installation of the FRP decking and report to the Resident Engineer any discrepancy with the contract drawings prior to release of the FRP deck fabrication.
 3. Determine quantities of FRP decking to complete the work.
 4. Non-slip Wearing Surface for FRP Decking.
 5. Other appurtenances or related work, as specified herein, or as directed by the Resident Engineer or as shown on the contract drawings.

1.2 SUBMITTALS

- A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 00700, GENERAL CONDITIONS.
- B. Submittals required under this section includes, but are not limited the following:
1. Manufacturer's Qualification: Submit proof of manufacturer's qualifications. The manufacturer of the FRP deck panels shall have an established acceptable performance history with FRP transit platforms and or bridge decks of a minimum of 3 years with a minimum of 5 separate applications.

2. Manufacturer's Plan: Submit the manufacturer's plan that details the manufacture of FRP decking. At a minimum, the plans shall include the following:
 - a. Materials - Provide details on fiber and resin such as fiber architecture, and mechanical properties to be used in the FRP manufacturing process.
 - b. Assembly - Provide assembly details for both shop and field-assembled components.
 - c. Wearing Surface - Provide manufacturer's technical data and installation instructions for non-slip wearing surface.
3. Shop Drawings: Submit shop fabrication drawings of the FRP decking with shop applied polymer aggregate overlay for review and approval. The following information shall be included as a minimum:
 - a. Cross sectional and overall dimensions of all FRP components, including details regarding FRP connections.
 - b. Recommended lifting method and locations:
 - i. Instructions and recommendations for panel delivery, storage and installation.
 - ii. Calculation of weight (pounds per square foot) of FRP deck assembly with wearing surface.
4. Product Information: Submit manufacturer's product information and test sheets for Non-slip Wearing Surface coating.
5. Design calculations prepared and stamped by a professional engineer registered in the State of MA
6. Samples: Submit one (1) - 12" by 12" square sample of the polyurethane and methyl methacrylate polymer aggregate overlay applied to a fiberglass substrate. The samples shall include the proposed color and surface texture.
7. Test Report: Test data demonstrating that the proposed materials and decking comply with the performance requirements specified in this Section.

1.3 PRODUCT HANDLING

- A. All materials and components shall be shipped, stored, handled, and installed in such a manner as to not degrade quality, serviceability, or appearance l.

- B. The materials and components shall be stored on wooden pallets or on a flat, clean surface to prevent damage and shall be covered to prevent ultraviolet sunlight exposure and ice prior to installation.
 - 1. Installation Support: Supplier shall provide a qualified technical representative for up to three (3) days to facilitate the installation procedure as an advisor. Installation of the FRP decking is not within the scope of supplier of the manufacturer or manufacturer's representative.
 - 2. Storage and Handling: Perform site handling and erection with conventional equipment and methods in accordance with the manufacturer's recommendations.

1.4 DESIGN CRITERIA

A. Design Criteria

- 1. Loading Criteria: FRP deck panels shall be designed as a non-composite, simple span to resist the following loads. These loads are to be combined in accordance with the requirements of the Massachusetts State Building Code (CMR 780).
 - a. Uniform pedestrian loading of 100 psf with a 300 lbs. concentrated load
 - b. Uplift load of 30 psf.
 - c. H 5 vehicle loading plus impact
 - d. Dead load and attachment of pedestrian shelter
- 2. Deflection criteria: FRP panels shall be designed to limit deflection under pedestrian live load to a maximum of $L/500$ with the span (L) measured from the center-to-center of panel support beams. Deflections shall be calculated assuming simple spans with no continuity over the panel floor beams.
- 3. Flexure Criteria: Unless otherwise approved by the Resident Engineer, the maximum allowable bending strain in the FRP panels shall be limited to 20% of strain to failure under service loads
- 4. Shear Criteria: Unless otherwise approved by the Engineer, the maximum allowable shear strain in the FRP panels shall be limited to 20% of strain to failure under service loads.
- 5. Crushing: Unless otherwise approved by the Engineer, the minimum crushing strength of the FRP panels shall be 150psi.

6. Fire Performance: FRP Decking shall meet the requirements for a Class 1 material per ASTM E84, in stations that meet or exceed the egress times specified in NFPA 130-10. The panels must be supplied as-tested. No field applications or changes will be allowed to the as-tested panels except for any necessary touch up or sealing. For Class I material compliance, all platforms shall have an intumescent coating applied to the underside of each platform section. The application of the intumescent coating shall be completed in the factory. Application of the intumescent coating in the field will not be permitted.
7. Temperature: Platforms shall operate in a temperature range of -40°F to 160°F.
8. Grating shall withstand a concentrated load of 300 lbs. or uniform load of 100 psf with minimum safety factor of 4.
9. Design Properties: All design properties shall be reduced statistically to at least 90% of the population of the material values that are expected to equal or exceed this tolerance bound with 95% confidence. The following environmental factors shall then be applied to these statistically reduced design values.

Environmental Factors		
Property	Strength Retention Factor	Modulus Retention Factor
Tensile/ Compression	0.88	0.95
Shear	0.92	0.97

PART 2 - PRODUCTS

2.1 MATERIALS OF CONSTRUCTION

- A. Vinyl Ester Resin: All resins shall be vinyl ester and shall be the same resin throughout the project.
- B. Fiberglass: All reinforcement shall be commercial grade E-glass fiber.
- C. Pigments: All pigments shall be polydispersion liquid pigments.
- D. Edge Coatings: Exposed edges of FRP decking shall have a two part polyurethane system that is designed for high UV exposure.
- E. FRP Panels:
 - 1. The deck panels shall be manufactured with a resin infusion process such that the top and bottom facesheet skins are integral to the webs. Assembly from separate skins and web shapes shall not be permitted. Double tee members shall also be fabricated as one piece using the resin infusion process. Fabricating the FRP tee stiffeners separately and either bonding or fastening them to a separate top panel will not be acceptable.
 - 2. Edges and ends must integral with the facesheet skins and seal the interior of the panel.
 - 3. The platforms shall be manufactured with a 2 pcf polyisocyanurate closed cell foam core in order to prevent any water from settling in the interior of the panel.
 - 4. Any areas that require drilled holes through the panel that would expose the foam to the elements should have a minimum of 16 pcf polyurethane foam designed for long term water exposure.
 - 5. If required, the platforms shall be manufactured with either a cross slope or crowned surface. The cross slope or crown shall be integral to the platform fabrication. Build-up of the wear surface to form a cross slope or crown will not be acceptable.
 - 6. The platforms shall be manufactured in the dimensions shown on the plans. Substituting smaller members that result in an increased number of joints will not be acceptable.
 - 7. The platforms shall be manufactured with embedded steel elements that are chemically interfaced to the FRP skins for connecting the platforms to the support beams and for

connecting rail posts, signage, rub strips and other items to the platforms.

8. The platforms shall have tactile warning tiles bonded in place prior to shipment. Refer to contract plans for tile type, size and location.
9. The color of all exposed FRP shall be uniform and shall be gray unless indicated otherwise in the contract plans.
10. Environmental protection: All exposed FRP surfaces shall be protected against weathering and ultraviolet damage.

F. Non-slip Polymer Aggregate Overlay:

11. Overlay shall be a non-skid, polyurethane and methyl methacrylate system with quartz aggregate that is shop applied to the top surface of the FRP platform.
12. The color of the wearing surface shall be uniform and shall be gray unless indicated otherwise in the contract plans.
13. The texture of the wearing surface shall be appropriate for pedestrian traffic and ADA compliant with a minimum coefficient of friction of 0.5.

G. Connection Hardware: All connection hardware shall be Type 304 stainless steel. The FRP decking shall be connected to the support beams with stainless steel clips that capture the support beams. If applicable, the deck panels shall be set to the proper slope using stainless steel shims prior to the final connection of the bolts and clips.

H. Grating: The grating shall be molded fiberglass grating flush with the top of the deck surface, slip resistant and ADA compliant.

2.2 PROPERTIES

A. Physical Properties: The table below details the minimum properties required for the Fiber Reinforced Polymer (FRP) Decking and the shop applied Polymer Aggregate Overlay.

Required Physical Properties for FRP Materials		
Physical Property	Requirement	ASTM
Barcol Hardness	Greater than 35	D2583
Glass Transition	Greater than 180°F	D4065
Coefficient of Thermal	Between 6 and 10×10^{-6}	D696
Moisture Equilibrium	Less than 2%	D570
Density	0.070 and 0.078 lbs/in ³	D792

Required Properties for Polymer Aggregate Overlay		
Physical Property	Requirement	ASTM
Tensile Strength @	1500 psi	D638-10
Elongation at fracture @ 68°F	150%	D638-10
Tensile Adhesion to FRP	400 psi	D4541-09

B. FRP Platform Properties.

Tensile/Compressive Strength (min)	27.0 ksi
Tensile/Compressive Modulus (min)	2400 ksi
In-Plane Shear Strength (min)	17.0 ksi
In-Plane Shear Modulus (min)	475 ksi
Deck Pin Bearing Strength (min)	30.0 ksi
Tensile/Compressive Strength in 90° Direction (min)	20.0 ksi
Tensile/Compressive Modulus in 90° Direction (min)	1800 ksi
Panel Crushing Strength from Wheel Load (min)	800 psi

C. Dimensional Tolerances and Weight

Dimensional Tolerances & Weight	
Dimensions (see Contract Plans)	Tolerance
Overall Platform Depth including wear surface	± 1/4"
Straightness (bow)	± 1/8" per
Platform Length/Width	± 1/4"
Weight	+/- 10%

2.3 MANUFACTURING

- A. Processing: Manufacture FRP decking as detailed in the contract plans and tolerances listed in Section 2.1. The FRP decking shall be reinforced with fiberglass elements to achieve the design criteria listed in Section 1.4.
- B. Quality Assurance: Provide specific quality assurance testing and measurements to assure finished FRP decking meet the functional and performance requirement for the intended application. This also includes mechanical testing to verify material and structural properties as well as post-manufacturing dimensional measurements. FRP decking supplier shall be ISO 9001 Compliant.

- C. Identification: Label the FRP decking with identification numbers consistent with the numbering system shown on the shop drawings. Each deck panel shall have a unique identifier to facilitate traceability of materials and processes.
- D. Documentation: Assemble and maintain project documentation for the FRP decking project as follows:
 - 1. Design data and calculations
 - 2. Shop drawings
 - 3. Manufacturing quality control records including material traceability and dimensional results
 - 4. Installation instructions
- E. Panel Marking: The manufacturer shall clearly mark each FRP pedestrian deck panel to indicate the serial number and nominal weight. The identification shall not be visible in the final installation.
- F. Approved Supplier: FRP decking shall be supplied by Composite Advantage, 750 Rosedale Drive, Ohio, 45402 or approved equal.

2.4 TESTING

- A. Full Scale Testing
 - 1. The FRP platform shall be tested in flexure. The specimen tested shall be comparable to the production platforms with a minimum width of 46". Apply 6" wide load footprint at the center (across the entire width) of the test specimen. Measure the deflection in the center of the loading footprint. Deflection cannot exceed the requirements in Section 1.4.A.2 when normalized for a distributed load. Failure load must exceed 5 times the service load.
 - 2. The FRP platform shall be tested for crushing strength. Apply a 10" x 10" load footprint to the top of the deck with the rigid support underneath. Platform must have a crushing strength in excess of 150 psi.

2.5 WARRANTY

- A. FRP decking supplier shall issue a twelve (12) month warranty against defects in workmanship and materials from the date of acceptance of FRP decking. Contractor shall provide warranty and any other required documentation from this section to the Authority or Authority's Resident Engineer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Installer/Erector shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of installation means Installer accepts substrates and conditions.

3.2 INSTALLATION

- A. General: Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as shown on the drawings or as required for installation.
- B. All units specified herein shall be installed in accordance with the manufacturer's instructions and as shown on the shop drawings or as directed by the manufacturer. Touch up or seal any damaged surfaces or edges of fiberglass shapes before installation.
- C. Accessories: Install clips, hangers, and other accessories required for erection of FRP units to supporting members and back-up materials.
- D. Anchor units in final position by bolting, welding or as otherwise designed. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.
 - 1. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.
 - 2. At welded connections apply rust inhibitive coating on damaged areas, same as shop applied material. Use galvanizing repair coating on galvanized surfaces.
 - 3. All connections shall be concealed within building finishes.
- E. Welding shall conform to requirements of the applicable building code and the appropriate sections of AWS D1.1, and shall be executed by experienced welders qualified by tests given in AWS D1.1, Appendix D, Parts II and III. Such tests shall be carried out with the same type electrodes to be used in this Work

- F. Surfaces to be welded shall be free from loose scale, slag, rust, and other foreign material, and shall be free of fins and tears. Stud welding shall be done before concrete floor fill is poured. Thoroughly clean and wire-brush steel anchorage items between structural steel.
- G. On completion of all welding, clean welds thoroughly of flux, rust, etc. Field touch prime all welds and abraded steel using zinc rich compound
- H. Notify Engineer in sufficient time so that inspection of completed welding can be made by testing agency under the Engineer's direction should he so require.

3.3 PERFORMANCE REQUIREMENTS

- A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory FRP units as required
- B. In addition to above, in-place FRP units may be rejected for any one of the following reasons:
 - 1. Exceeding the specified installation tolerances.
 - 2. Irreparable damage during construction operations.
 - 3. Exposed to view surfaces which develop surface finish deficiencies.
 - 4. Non-compliance with acceptance criteria listed below.

3.4 GENERAL ACCEPTANCE CRITERIA

- A. Units shall meet specifications. No structural deficiencies, cracks, loose inserts or anchors, exposed steel, or other defects shall be permitted.
- B. Appearance Acceptance Criteria: When viewed at a distance of 10 ft. in natural daylight, exposed surfaces shall be uniform in color, texture, and finish shall be within the range of approved mock-up samples when compared side by side. Panel edges and details of decoration shall be clear, well defined and true to line within specified alignment tolerances. Following is a list of finish defects which are unacceptable and cause for rejection of panels:
 - 1. Ragged or irregular edges outside manufacturer's approved acceptance criteria.
 - 2. Non-uniformity of textures or color.
 - 3. Foreign material embedded in the face.
 - 4. Visible repairs.
 - 5. Visible cracks.

6. Burns or other damage resulting from welding work.
- C. FRP units shall be reviewed for compliance with specifications in three stages as follows:
 1. Units will be inspected at fabrication plant.
 2. Units will be inspected after delivery to site.
 3. Units will be inspected after installation and final cleaning.
- D. Repair or replace units as directed by the Engineer.

3.5 CLEANUP

- A. At the completion of the work all labels shall be removed and the units shall be cleaned and left free of blemishes.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

- A. Separate measurement and payment will not be made for work required under this section, including all labor, equipment, materials, and incidentals including all stainless steel and galvanized fasteners, survey, supervision and all incidentals necessary to complete the work to the satisfaction of the Engineer, but all costs in connection therefore shall be included in the Contract Lump Sum Price for Item 0613.019 - Access Platform.

4.2 PAYMENT ITEMS

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
0613.019	ACCESS PLATFORM	LS

END OF SECTION